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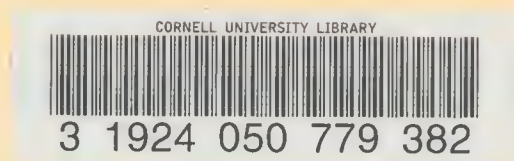
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THE
INDIGENOUS GRASSES
OF
NEW ZEALAND.

ILLUSTRATED BY
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Draftsman to the Geological Survey Department.

Parts III. & IV., 22 Plates.—(To be completed in Five Parts)

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7.—AGROSTIS PILOSA.

PILOSE BENT GRASS.

(Plate XXII.)

AGROSTIS PILOSA, A. Richard. Flora, I., 134, t. 23. Hook. fil., Fl. N.Z., I., 297. Handb. N.Z. Flora, I., 329.

A LARGER and more robust grass than the last. *Flowers* November—March. Annual or Perennial. *Culms* tufted, 12—36 inches high. *Leaves* flat, scaberulous on the edges, and sometimes pilose at bottom; *ligule* broad, short and rounded at top. *Panicle* large, 6—18 inches long, 3—10 inches broad, branches whorled, scaberulous. *Spikelets* $\frac{1}{6}$ -inch long, on slender scaberulous pedicels. *Empty glumes* nearly equal, margins and keel scabrid, 1-nerved. *Flowering glume* sessile, truncate, with 4 prominent teeth, 5-nerved, pilose, awned near the middle of the back. *Palea* oblong, bifid, 2-nerved. *Scales* entire, narrow-lanceolate, acute. *Stigmas* nearly sessile. DISTRIBUTION OF SPECIES: NEW ZEALAND, CHATHAM ISLANDS.

This is an abundant and wide-spread grass in both Islands, from sea-level to 3000 feet altitude. It differs much from the previous species *A. æmula*, in its larger size and more robust habit, in its more silky or pilose flowering glume, more distinct prolongation of the rachis at back of palea, terminating in a pencil of silky hairs, and broader pilose leaves. In rich damp ground not subject to summer droughts this grass is perennial, and acquires in such places considerable bulk; it is closely cropped by cattle and sheep, and may be considered a valuable grass both as late and early feed; specimens having been collected in the Botanical Garden, Wellington, in flower, during the late severe winter. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: MOUNTAINOUS DISTRICTS OF THE INTERIOR—Colenso. WELLINGTON—Buchanan. SOUTH ISLAND: ASTROLABE HARBOUR, D'URVILLE ISLAND, NELSON. SUB-ALPINE DISTRICTS: NELSON—H. H. Travers. SOUTHERN ALPS, CANTERBURY—Sinclair, Haast; OTAGO LAKE DISTRICT—Hector and Buchanan; DUNEDIN—Buchanan; CHATHAM ISLANDS—H. H. Travers.

Reference to Plate XXII.: Fig. 1. Plants. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary.



Agrostis pilosa, A. Rich.

8.—AGROSTIS BILLARDIERI.

BILLARDIER'S BENT GRASS.

(Plate XXIII.)

AGROSTIS VAGINATA, Steudel.

LACHNAGROSTIS BILLARDIERI, Trinius.

AVENA FILIFORMIS, Labill. Flora Nov. Holl., I., 24, t. 31.

DEYEUXIA BILLARDIERI, Kunth. Hook. fil., Fl. N.Z., II., 298.

AGROSTIS BILLARDIERI, R. Brown. Hook. fil., Fl. Tasm., II., 115; Handb. N.Z. Flora, I., 329.

A ROBUST glabrous or scaberulous grass. *Flowers* December—March. Annual or Perennial. *Culms* tufted, 6—18 inches high. *Leaves* 6—10 inches long, broad or narrow, glabrous or pilose; *ligule* short, lacerate on the broad top. *Panicle* 4—8 inches long, open, branches long, whorled, scaberulous. *Spikelets* $\frac{1}{6}$ — $\frac{1}{4}$ inch long, on long slender scaberulous pedicels. *Empty glumes* nearly equal, scabrid on the margins and keel, 3-nerved, lateral nerves very short. *Flowering glume* shorter, truncate, with 4 teeth, silky at base, 5-nerved; awn twice as long as the glume, proceeding from the middle of the back. *Palea* with a long silky pedicel at back. *Scales* linear-lanceolate, entire. *Styles* and *Stigmas* equal in length. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

This and the two previous species are closely connected, having many intermediate forms, but in the specific plants so structurally different as to be easily distinguished. The present species may be characterized as the smallest of the three in size, but largest in the details of the inflorescence. This species may also be considered as of much value in pasture, it is an early grass on the drier districts of the North Island, and has a very extensive range of growth and adaptation to circumstance of soil, moisture, and heat, growing with equal vigour in littoral swamps, on sand-hills, and good pasture land; it may also be found in waste places among stones or scrub, being annual on dry clay hills, and perennial on good moist land.

In Vol. VII. of Bentham and Mueller's "Flora Australiensis," recently published, some of the New Zealand *Agrostis* have been removed from that Genus and placed in *Deyeuxia*, from possessing a silky pedicel at the back of the palea. As this character is very inconstant with some of the New Zealand species, being very small in some, and frequently absent in *A. æmula*, it has been considered inexpedient in the present work to follow Bentham in this, and so to add a new Genus to the New Zealand grasses, or otherwise alter the present arrangement found in Hooker's Handbook of the New Zealand Flora, as much confusion might ensue to those who refer to that work as a guide. DISTRIBUTION IN NEW ZEALAND. NORTH ISLAND: BAY OF ISLANDS AND AUCKLAND. EAST COAST—Sinclair, Colenso, Banks, and Solander. ISLANDS OF THE EAST COAST AND WELLINGTON—Buchanan. SOUTH ISLAND: NELSON—H. H. Travers; CANTERBURY—Armstrong; DUNEDIN—Buchanan.

Reference to Plate XXIII.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Grain.



Agrostis Billardieri, Br.

10.—AGROSTIS AVENOIDES.

OAT-LIKE BENT GRASS.

(Plate XXIV. A.)

AGROSTIS AVENOIDES, Hook. fil., Handb. N.Z. Flora, I., 330.

A SMALL glabrous grass. *Flowers* January—February. *Roots* perennial. *Culms* rigid, 6—12 inches high, slender. *Leaves* short, numerous, involute, slender; *ligule* short, truncate. *Panicle* much contracted, branches very short, $\frac{1}{6}$ — $\frac{1}{4}$ -inch long. *Empty glumes* rigid, scabrid on the margins and keel, 3-nerved, lateral nerves (when present) very short. *Flowering glume* sessile, narrow, truncate with 4 teeth, hard, 5-nerved, scabrid on the nerves, silky at the base; awn nearly twice as long as the glume, proceeding from the middle of the back, twisted, recurved. *Palea* nearly as long as the glume, 2-nerved, with a long silky pedicel at back. *Scales* entire, variable, obtuse or acute. *Stigmas* nearly sessile.

DISTRIBUTION OF SPECIES: NEW ZEALAND.

An abundant grass in several districts of the South Island, from near sea-level to 3000 feet altitude; it is freely eaten by all kinds of stock, and may be considered as a good pasture grass; the foliage is short and close in growth, and assists in many places in forming a sward amongst the *Danthonia* tussocks. This grass, through injudicious burning by stockowners, has suffered much during the last twenty years, and is now chiefly found on the banks of creeks and damp places.

DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: NELSON, SUB-ALPINE DISTRICTS—H. H. Travers; CANTERBURY—Sinclair, Haast, Armstrong; OTAGO LAKE DISTRICT (3000 feet altitude)—Hector and Buchanan; CLUTHA RIVER AND TRIBUTARIES—Buchanan.

Reference to Plate XXIV. A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7, 7'. Scales. 8. Ovary.

9.—AGROSTIS SETIFOLIA.

ALPINE BENT GRASS.

(Plate XXIV. B.)

DEYEUXIA SETIFOLIA, Hook. fil., Fl. N.Z., I., 299, t. 65 B.

AGROSTIS SETIFOLIA, Hook. fil., Handb. N.Z. Flora, I., 329.

A SMALL alpine grass. *Flowers*—January. *Roots* perennial. *Culms* tufted, glabrous, grooved, 6—8 inches high. *Leaves* very narrow, involute, shorter than the culms, glabrous; *ligule* oblong. Panicle 1—2-inches long, contracted, branches short. *Spikelets* few, $\frac{1}{10}$ — $\frac{1}{8}$ -inch long, shining. *Empty glumes* unequal, 3-nerved, lateral nerves short. *Flowering glume* sessile, truncate, 4-toothed, $\frac{1}{3}$ shorter than the empty glumes, 5-nerved, and with long silky hairs at base; awn nearly twice as long as the glume, proceeding from the middle of the back. *Palea* nearly as long as the glume, bifid, 2-nerved, and with a long silky pedicel at back. *Scales* entire, oblong, acute. *Styles* short. *Stigmas* longer, feathery. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This grass, as far as at present known, appears to be limited in distribution to a few alpine localities in the North Island; it possesses a close habit of growth and succulent nature, and would prove a valuable addition to any pasture. The alpine pastures of New Zealand are unvisited during winter owing to the presence of snow, but are much frequented by sheep in the South Island during summer, when the lower lands are short of feed; and, no doubt, when the alpine portions of the Tararua and Ruahine Mountains, where this species is only found, are opened up for stock by clearing away the bush from their lower slopes, their grazing capabilities will prove equally as valuable as those of the South. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: RUAHINE MOUNTAIN AND LAKE WAIKARE—Colenso; TARARUA MOUNTAIN—H. H. Travers.

Reference to Plate XXIV. B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary.



A. *Agrostis avenoides*, *Hook. fil.*
 B. " *setifolia*, *Hook. fil.*

11.—AGROSTIS YOUNGII.

YOUNG'S BENT GRASS.

(Plate XXV.)

AGROSTIS YOUNGII, Hook. fil., Handb. N.Z. Flora, I., 330.

A TALL robust grass. *Flowers* December—February. *Roots* perennial. *Culms* 1—3 feet high, glabrous or slightly scaberulous. *Leaves* flat, $\frac{1}{6}$ — $\frac{1}{4}$ -inch broad. *Panicle* 4—6-inches long, erect, much contracted, flexuose, branches very short. *Spikelets* $\frac{1}{6}$ — $\frac{1}{4}$ -inch long. *Empty glumes* rigid, glabrous, scabrid on the margins and keel, nerveless. *Flowering glume* nearly as long, truncate, with 4 teeth, pedicelled, 5-nerved, scabrid on the nerves; awn very short, nearly terminal or proceeding at $\frac{1}{3}$ from the top. *Palea* nearly as long as the glume, bifid, 2-nerved; pedicel short with silky hairs. *Scales* entire, linear-lanceolate. *Ovary* plano-convex. *Styles* very short. *Stigmas* long, feathery. DISTRIBUTION OF SPECIES: NEW ZEALAND.

A common grass in the South Island, varying much in size according to soil and situation, the foliage in the larger states is coarse but succulent, and would form a valuable constituent of mixed fodder. In the district between the Clutha and Mataura Rivers, Otago, this grass is abundant, and is much eaten by stock. In all places where undrained lands and abundant rains are common, all the species of the *Agrostis* family will possess much value as pasture grasses, but, however hardy they may be, they enjoy no immunity from overfeeding by either stock or rabbits, and ought to benefit by periods of rest, or the finer kinds will inevitably be killed by sun and frosts. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: NELSON—H. H. Travers; CANTERBURY—Haast; KAIHIKU HILLS, OTAGO—Buchanan.

Reference to Plate XXV.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glume. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, 2 views.



Agrostis Youngii, Hook. fil.

12.—AGROSTIS QUADRISETA.

SPIKED BENT OR REED GRASS.

(Plates XXVI. A. and B.)

AGROSTIS ELATIOR, Steud.

AVENA QUADRISETA, Labill., Pl. Nov. Holl., I., 25 t. 32.

BROMIDIUM QUADRISETUM, Nees. Hook., Londn. Journ., II., 416.

AGROSTIS QUADRISETA, R. Brown, Prod., 171. Hook. fil., Fl. Tasm., II., 114; Fl. N.Z., I., 296; Handb. N.Z. Flora, I., 330.

A VERY variable species. *Flowers* December—February. *Roots* perennial. *Culms* 6 inches to 4 feet high, slender or robust. *Leaves* shorter than the culms, flat or involute, often setaceous, glabrous, or scabrid. *Panicle* 2—6-inches long, slender or stout, densely spiked, or interrupted at bottom, lower branches sometimes spreading, whorled. *Spikelets* pedicelled, $\frac{1}{10}$ — $\frac{1}{8}$ -inch long, shining. *Empty glumes* scabrid on the margins and keel, 1-nerved. *Flowering glume* nearly as long, 5-nerved, on a short bearded pedicel, truncate with 4 teeth; awn short, stout, variable in point of attachment. *Palea* nearly as long as the glume, with a silky pedicel at back, 2-nerved. *Ovary* nearly plano-convex. *Stigmas* sessile, feathery. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

This is a very variable grass both in size and value in pasture, the smaller forms being generally most succulent, especially in sub-alpine districts, the larger again being harsh, and best adapted for cattle. An extraordinary variety of this species is found abundant near Lake Guyon, in the district of Nelson, at an altitude of 2000 feet. (See Plate XXVI. B.) Structurally, this variety differs much from the species, being probably the result of climatic influences. The abnormal condition of the flowers preventing the possibility of its continuance by seed, would indicate the presence of plants with unaltered flowers in the district to continue it there, although none has been collected. This variety may be described as a very robust, rigid, close-spiked grass, having all the parts of the inflorescence abnormally formed, the most prominent feature being the frequent presence of one or two stout rigid pedicels without hairs at the back of the palea, presenting an instance of a branched prolongation of the rachis beyond the floret. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: AUCKLAND, BAY OF ISLANDS—Cunningham, Kirk; SOUTH ISLAND: NELSON—H. H. Travers; CANTERBURY—Armstrong; OTAGO—Buchanan.

Reference to Plate XXVI. A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary.

Reference to Plate XXVI. B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7, 7', 7'. Scales. 8. Ovary, with scales, &c., attached. 8'. Ovary.



Agrostis quadriseta, Hook. fil.

GENUS XV.—ARUNDO, Linnæus.

Spikelets excessively numerous, 1—5-flowered, in large, nodding, pendulous, or erect panicles. *Empty glumes* nearly equal, very long, lanceolate, acuminate. *Flowering glumes* pedicelled, long, lanceolate, very silky, entire, or with 2 lateral short or long awns; central awn much longer, straight or twisted. *Palea* short. *Scales* 2. *Stamens* 3. *Grain* free terete. DISTRIBUTION OF GENUS: VARIOUS PARTS OF THE WORLD. *Etymology*: From “arundo” in Latin, “a reed.”

1.—ARUNDO CONSPICUA.

PLUMED TUSSAC GRASS.

(Plate XXVII.)

AGROSTIS AUSTRALIS, A. Rich.

AGROSTIS AUSTRALIS, A. Cunn., Prod.

AGROSTIS CONSPICUA, A. Cunn., Prod.

ACHNATHERUM CONSPICUUM, Palisot.

GYNERIUM (?) ZEALANDICUM, Steud.

CALAMAGROSTIS CONSPICUA, Gmelin.

AGROSTIS PROCERA, A. Rick.

ARUNDO CONSPICUA, Forst. Hook. fil., Fl. N.Z., I., 299.

ARUNDO CONSPICUA, Forst. Hook. fil., Handb. N.Z. Flora, I., 331.

A LARGE ornamental tussac grass. *Flowers* December—January. *Culms* 6—12 feet high. *Leaves* involute, narrow, often scabrid and cutting; *ligule* 0, or a waved line of short hairs round the mouth of the sheath. *Panicle* 1—2 feet long, shining, white or fulvous, nodding or pendulous. *Spikelets* 1—3-flowered, pedicel capillary. *Empty glumes* $\frac{1}{2}$ —1 inch long, 1-nerved, very narrow, tapering, apiculate. *Flowering glume* 3-nerved, with numerous long silky hairs proceeding from near the base, lateral and central awns included within the empty glumes. *Palea* narrow, 2-nerved. *Scales* fleshy, crowned with about 12 long cilia. *Ovary* elongate, narrow. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This grass often forms a conspicuous feature in the scenery of New Zealand, and, on low undulating hills or fringing watercourses, especially when associated with the cabbage-tree, *Cordyline australis*, presents a unique feature in landscape botany. Several varieties of *Arundo* are found, especially in the North and on the islets off the coast, but the whole of these varieties may be arranged under two species—those with nodding or pendulous panicles, having the florets and awns included within the empty glumes, under the present species, *Arundo conspicua*; and those with upright panicles, having the floret awns not included within the empty glumes, under the next species, *Arundo fulvida*.

The economic value of the New Zealand *Arundo* grasses, as fodder plants, has been much overlooked, for, if cut down when in flower, they will be found both succulent and agreeable to stock. Experiments made recently on an allied species (*Arundo sellowiana*, Schultes, better known as *Gynerium argenteum*, Nees, the Pampas grass of South America), by Sir George Grey, at Kawau, and Dr. Curle, at Manawatu, favour the view that these coarse grasses have been neglected, and that they only require to be cut down at the proper time to insure that stock will eat them greedily. DISTRIBUTION IN NEW ZEALAND: COMMON EVERYWHERE AT LOW ALTITUDES.

Reference to Plate XXVII.: Fig. 1. Branch of a Panicle. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glumes. 6. Nervation of Palea. 7. Scale. 8. Pistils and stigmas. 9. Grain.



Arundo conspicua, Forst.

2.—ARUNDO FULVIDA.

ERECT PLUMED TUSSAC GRASS.

(Plate XXVIII.)

ARUNDO FULVIDA, Buchanan, Trans. N.Z. Institute, VI., 242.

ARUNDO CONSPICUA, Forst. VAR. FULVIDA, Kirk. Trans. N.Z. Institute, X., App. XLIII.

A LARGE ornamental tussac grass. *Flowers* December—January. *Culms* 4—6 feet high. *Leaves* involute, broad, smooth or sparsely covered with silky hairs, and with long attenuate curving points; *ligule* 0, or with a waved line of short hairs on mouth of sheath. *Panicle* 12—18-inches long, dense-flowered, erect, bright fulvous colour. *Spikelets* 1—2-flowered, pedicels capillary. *Empty glumes* $\frac{1}{3}$ — $\frac{1}{2}$ -inch long, 1-nerved, narrow, tapering, apiculate. *Flowering glume* 3-nerved, with numerous long silky hairs proceeding from near the base, lateral awns very short, central awn not included. *Palea* 1-nerved, short, oblong, tapering. *Scales* fleshy, crowned with about 12 cilia. *Ovary* elongate, narrow. DISTRIBUTION OF SPECIES: NEW ZEALAND.

It has been considered expedient in the present work to retain the specific distinction of this grass, in order that the numerous varieties hitherto included under the former species might be arranged into two natural groups. The two species thus adopted will occupy the extreme limits of a large group of varieties, and probably those nearest allied to the present species may prove the most valuable as fodder plants, from their superior succulence and smoothness. The long straight flower stems, the kakaho of the Maoris, are worthy of attention in husbandry as a first-class material for thatching stacks or out-houses. In the primitive state of New Zealand colonial society, these grasses, known as toetoe, as also raupo, *Typha angustifolia*, were much used in roofing buildings both in town and country. The Maoris also produced beautiful specimens of plaiting for the interior decoration of walls from the split stems of the kakaho, some of which may still be seen near Wellington.

It is highly probable that the cultivation of the *Arundo* grasses under notice might prove as remunerative as many of the exotic grasses at present recommended. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: POVERTY BAY, SHORES OF WELLINGTON HARBOUR AND COOK STRAIT NEAR WELLINGTON—Buchanan.

Reference to Plate XXVIII.: Fig. 1. Branch of Panicle. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, with stigmas as protruded past the Palea.



Arundo fulvida, n. sp.

GENUS XVI.—DANTHONIA, Decandolle.

TUFTED or tussac grasses. *Leaves* flat or involute. *Panicle* effuse or contracted. *Spikelets* pedicelled, the rachis of the spikelet articulating above the outer glumes. *Empty glumes* unequal, keeled, awnless. *Flowering glumes* pedicelled, articulating at the base of each floret, convex at the back, 9-nerved, broadly 2-fid, the divisions cuspidate or awned, dorsal awn from between the divisions, long, slender or stout, filiform or flat and twisted at the base; the awn in some species much reduced, silky, with scattered hairs on the lower half or glabrous, fringed, or with distant tufts of hairs on margin and back, in some cases the hairs are arranged in circles round the glume. *Palea* 2-fid. *Scales* glabrous, fleshy, crowned with long cilia. *Stamens* 3. *Ovary* glabrous. *Grain* free. DISTRIBUTION OF GENUS: TEMPERATE REGIONS OF THE NORTHERN HEMISPHERE, SOUTH AFRICA, AUSTRALIA, TASMANIA, NEW ZEALAND. *Etymology*: Named in honor of M. Danthoine, a French Botanist.

ARRANGEMENT OF THE SPECIES:—

I.—*Empty glumes* shorter than the flowering. *Flowering glumes* with scattered silky hairs on the lower half, and fringed on the margins and back with long silky hairs; in *D. Cunninghamii*, often margins only fringed.

Awn subulate, not flattened or twisted.

| | | | |
|--|-----|-----|-----------------------------|
| Panicle open, large, effuse, branches 6—10-inches long | ... | ... | 1. <i>D. Cunninghamii</i> . |
| Panicle ovate, 3—4-inches long, lax, open; leaves short | ... | ... | 2. <i>D. ovata</i> . |
| Panicle short, close, ovoid, branches $\frac{1}{2}$ —1-inch long | ... | ... | 3. <i>D. bromoides</i> . |

Awn flattened and often twisted at the base.

| | | | | |
|---|-----|-----|-----|---------------------------|
| Panicle very lax, open; leaves setaceous | ... | ... | ... | 4. <i>D. Raoulii</i> . |
| Panicle open, $1\frac{1}{2}$ -inches long, of 3—5 spikelets; leaves very short, setaceous | ... | ... | ... | 5. <i>D. australis</i> . |
| Panicle very lax, open; leaves flat, coriaceous | ... | ... | ... | 6. <i>D. flavescens</i> . |

II.—*Empty glumes* longer than the flowering, and including them. *Flowering glume* with distant tufts of silky hairs on margins and back; or circles of hair round the glume, fringed with hairs on margins in *D. Buchanani*, and *D. pauciflora*.

Awn subulate, not twisted.

Flowering glume with a circle of hairs at bottom, and distant tufts of hairs

on margins and back 7. *D. pilosa*.

Awn twisted at the base.

Flowering glume with a circle of long hairs beneath the lobes, and a

second circle of shorter hairs near the bottom 8. *D. semi-annularis*.

Flowering glume fringed on the margins only with long silky hairs ... 9. *D. Buchanani*.

Awn very short, lobes not longer than their base.

Flowering glume with one tuft of hairs on each margin 10. *D. nuda*.

Flowering glume with a fringe of hairs on the lower half of margins ... 11. *D. pauciflora*.

1.—DANTHONIA CUNNINGHAMII.

SMALL-FLOWERED OAT TUSSAC GRASS.

(Plate XXIX.)

DANTHONIA ANTARCTICA, VAR. B. LAXIFOLIA, Hook. fil., Fl. N.Z., I., 303.

AGROSTIS PILOSA, A. Cunn., not A. Rich.

DANTHONIA RIGIDA, Hook. fil., Fl. N.Z., I., t. 69A., not Raoul.

DANTHONIA CUNNINGHAMII, Hook. fil., Handb. N.Z. Flora, I., 332.

A LARGE tussac grass, found from sea-level to 2500 feet altitude. *Flowers* December—January. *Culms* 3—5-feet high, $\frac{1}{4}$ -inch diameter, glabrous or pilose below. *Leaves* 3—4-feet long, coriaceous, concave, $\frac{1}{4}$ -inch broad, glabrous; sheaths broad; *ligule* 0, or a narrow line of short hairs round the mouth of sheath. *Panicle* large, drooping, 10—18-inches long, branches many or few in distant pairs, or single, very slender, 6—12-inches long, pubescent. *Spikelets* alternate on the branches, $\frac{1}{4}$ — $\frac{1}{2}$ -inch long, 2—8-flowered. *Empty glumes* unequal, 3-nerved. *Flowering glume* deeply 2-fid, 9-nerved, glabrous or sprinkled with hairs on lower half, fringed on margins with long hairs; awn recurved or straight, not flattened or twisted at the base, pedicel tufted with long hairs. *Palea* bifid on top, and with long straggling hairs on the margins. *Scales* linear-oblong, acute, crowned with long cilia. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This grass is widely distributed in New Zealand, but seldom anywhere abundant. It varies much in size in different localities, but, although found growing under considerable differences of climate, little change can be observed in its structure, a small-flowered form found on the shores of Hicks Bay, Auckland, being nearly identical with specimens from the Mataura Valley, Southland. The sub-alpine forms of this grass also show little change, thus affording an argument in favour of the two species *D. Raoulii* and *D. flavesces* being distinct from the present. The twisted awn in the latter species is, however, of very little importance as a specific distinction, being very inconstant, and apparently varying with the amount of moisture in the atmosphere at the time of flowering. From some such cause the broad awns of both *D. Raoulii* and *D. flavesces* are frequently straight on one half of the panicle, and it is sometimes difficult to find a single twisted awn on an entire panicle.

Much that has been said regarding the economic value of the various species of *Arundo* as fodder plants, may also be applied to the large tussac *Danthonias*, but the full value of these large grasses cannot be satisfactorily proved without a certain amount of cultivation. The *Danthonias* possess a

superior adaptation to the climate of New Zealand to introduced grasses, as many of the latter when left to their own resources soon disappear, while the smaller species of *Danthonia* are increasing every season, and displacing the introduced grasses. They are certainly more permanent than many of the common exotics, such, for instance, as *Lolium perrene*, which often requires continued sowing to preserve it. In agriculture they also compare favourably with exotics as fodder plants if cut down at the proper time. Horses and cattle eat the succulent panicles of the tussock species, when in flower or seed, with apparent relish, and all kinds of stock feed greedily on the young growth after burning. DISTRIBUTION IN NEW ZEALAND: FROM SEA-LEVEL AT HICKS BAY, AUCKLAND, TO SOUTHLAND—J. Buchanan; STEWART ISLAND—W. Petrie.

Reference to Plate XXIX. : Fig. 1. Branch of a Panicle. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, styles, and stigmas. 9. Grain.



Danthonia Cunninghamii, Hook. fil.

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4.—DANTHONIA RAOULII.

NARROW-LEAVED OAT TUSSAC GRASS.

(Plate XXX.)

DANTHONIA RIGIDA, Raoul. Hook. fil., Fl. N.Z., I., 303.

DANTHONIA RAOULII, Steud. Hook. fil., Handb. N.Z. Flora, I, 332.

A VERY large tussac grass, from sea-level to 4000 feet altitude. *Flowers* December—January. *Culms* 3—8-feet high, $\frac{1}{4}$ -inch diameter. *Leaves* 3—6-feet long, coriaceous, involute and filiform; *ligule* 0, or a line of short hairs round the mouth of sheath. *Panicle* large drooping, 10—18-inches long; branches 6—12-inches long, distant, often sub-dividing near the bottom. *Spikelets* alternate on the branches, $\frac{1}{2}$ — $\frac{3}{4}$ -inch long, 4—8-flowered. *Empty glumes* unequal, 3—5-nerved. *Flowering glume* deeply 2-fid, and shortly awned on the lobes, 9-nerved, covered with numerous short hairs on the lower half, margins and back fringed with long hairs, awn flattened and twisted, often straight; pedicel tufted with long hairs. *Palea* bifid at top, with straggling long hairs on the margins. *Scales* oblong-acute, crowned with numerous cilia. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This species forms the largest tussacs of the family, and was very abundant in Otago and Southland before the occupation of the country by settlers. At that time the pasture was very superior, chiefly from the shelter afforded by the numerous large tussacs to the growth of the smaller grasses, which were then abundant. Injudicious burning, however, had destroyed all these finer grasses before the enclosure of the land by fencing. On improving land intended exclusively for pastoral purposes, or for the raising of large stock in districts exposed to cold winds, it may be questioned whether the entire destruction of the native grasses, especially the larger tussac kinds, is judicious, as their conservation, or culture, where they do not exist, would certainly prove an element of profit, not only from their own intrinsic value as food, but also from their sheltering all kinds of stock, as well as protecting from the nipping winds the smaller grasses which should form the bulk of every pasture. The indigenous grasses of New Zealand are, undoubtedly, more permanent and fattening than the introduced grasses of cultivation, and it might prove expedient in many districts to adopt a mixed system, by which the larger tussac grasses, both native and introduced, might be planted out as shelter along with the main pasture composed of the most permanent species of which seed can be procured,

whether exotic or indigenous, as not only would increased profit accrue by the adoption of such a system, but the painful spectacle be avoided of well-bred sheep with no other shelter from the cold than a wire fence. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: RUAHINE MOUNTAIN (3500 feet)—Colenso; TARARUA MOUNTAIN (4000 feet)—Mitchell; MIDDLE ISLAND: AKAROA—Raoul; ALPS OF CANTERBURY—Sinclair and Haast; MILFORD SOUND—Lyll; OTAGO LAKE DISTRICT (2000 feet)—Hector and Buchanan.

Reference to Plate XXX.: Fig. 1. Branch of a Panicle. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Grain.



Danthonia Raoulii, Steud.

5.—DANTHONIA AUSTRALIS, N.S.

WIRY-LEAVED OAT GRASS.

(Plate XXXI.)

DANTHONIA RAOULII, Steud. VAR. A. AUSTRALIS, Buchanan. Trans. N.Z. Inst., IV., 224.

A SMALL rigid grass, growing in dense tussac masses, at 6000 feet altitude. *Flowers* January. *Culms* 8—16-inches high. *Leaves* 1—4-inches long, glabrous, erect, very narrow and involute, rigid, setaceous, distichous, secund on the outer culms; *ligule* 0, or a line of short hairs round the mouth of the sheath, and long cilia on each side. *Panicle* 1—1½-inches long, open, 2-branched. *Spikelets* 3—5, with generally 2 spikelets on each branch, and one on the terminal rachis, ½-inch long, 5—7-flowered. *Empty glumes* nearly equal, 5- and 7-nerved. *Flowering glume* deeply 2-fid and shortly awned on the lobes, 9-nerved, glabrous, with silky margins and back fringed with long hairs, awn flattened and twisted, pedicel tufted with long hairs. *Palea* bifid at top, with straggling hairs on the margins. *Scales* ovate-acute, crowned with short cilia. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This grass is found at considerable altitudes in the South Island, and is covered by the snows of winter during several months in the year. It forms a very coarse herbage for sheep, although the early growth in spring may be more grateful and nutritious. The close compacted mass of stems, sheathing leaves, and roots becomes blanched and succulent, and is much relished by rats, who swarm everywhere on the pastures of the South Island, and are purely vegetable feeders in such localities. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: KAIKOURA MOUNTAINS (4000—6000 feet)—J. Buchanan; LAKE GUYON DISTRICT (5000—6000 feet)—H. H. Travers.

Reference to Plate XXXI.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, styles, and stigmas.



Danthonia australis, n.s.

6.—DANTHONIA FLAVESCENS.

BROAD-LEAVED OAT TUSSAC GRASS.

(Plate XXXII.)

DANTHONIA FLAVESCENS. Hook. fil., Handb. N.Z. Flora, I., 332.

A LARGE coarse tussac grass, ascending to 3000 feet altitude. *Flowers* January—February. *Culms* 3—5-feet high, $\frac{1}{4}$ -inch diameter. *Leaves* 3—4-feet long, concave or flat, $\frac{1}{2}$ -inch or more broad, glabrous. *Sheaths* broad; *ligule* o, or a line of very short hairs round the mouth of sheath, with often a tuft of long hairs on each side. *Panicle* 10—18-inches long, branches few, 6—10-inches long. *Spikelets* alternate, $\frac{1}{4}$ — $\frac{3}{4}$ -inch long, 2—8-flowered, awn flat, and often twisted at bottom. *Empty glumes* nearly equal, 5—7-nerved. *Flowering glume* deeply 2-fid, and shortly awned on the lobes, 9-nerved, covered with numerous short hairs on the lower half, margins and back fringed with long hairs, pedicel tufted with long hairs. *Palea* bifid at top, and with straggling long hairs on margins. *Scale* oblong, acute, and crowned with numerous cilia. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This species is chiefly found at great elevations, and is generally the largest and probably the most ornamental of the group. It is commonly known as the snow grass, although several other tussac grasses, both *Danthonias*, and *Schœnus pauciflorus*, are also known by the same name. This is a valuable grass on the upland sheep runs of the Middle Island, affording both shelter and food for sheep during continued snow storms, and, according to Mr. Travers, many sheep are saved every winter through its protection, although frequently covered by snow for weeks, the sheep even under such adverse circumstances being always found in good condition, the tussacs affording them both shelter and food. By cutting as fodder when the plant is in flower, an abundant supply of winter food could be secured that would serve to keep stock in condition during the hard winter months. It may also be noticed here that the tussac *Danthonias* can afford an unlimited amount of fibre material for the manufacture of paper, whenever required. DISTRIBUTION IN NEW ZEALAND: MIDDLE ISLAND: ALPS OF CANTERBURY—Sinclair and Haast; OTAGO LAKE DISTRICT (2000 feet)—Hector and Buchanan; ROCK AND PILLAR RANGE TO MAUNGATUA HILL, WEST TAIERI, OTAGO—W. Petrie.

Reference to Plate XXXII.: Fig. 1. Branch of a Panicle. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary and stigmas, as protruded past the Palea.



Danthonia flavescens, Hook. fil.

7.—DANTHONIA PILOSA.

PURPLE-AWNED OAT GRASS.

(Plate XXXIII.)

DANTHONIA PILOSA, R. Brown. Hook. fil., Fl. Tasm., II., 120; Fl. N.Z., I., 303.

DANTHONIA PILOSA, R. Brown. Hook. fil., Fl. N.Z., I., 303.

DANTHONIA SEMI-ANNULARIS, R. Brown. Hook. fil. VAR. B. PILOSA, Handb. N.Z. Flora, I., 333.

DANTHONIA PILOSA, R. Brown. Benth. Flora Australiensis, VII., 594.

A SLENDER or rigid tufted perennial grass, found from sea-level to 6000 feet altitude. *Flowers* November—January. *Culms* 1—2-feet high, pilose. *Leaves* involute, filiform or flat, pilose; sheathing leaves short; *ligule* 0, or a line of short hairs round mouth of sheath, with a tuft of long hairs on each side. *Panicle* 2—3-inches long, contracted, more open when in flower, with a few erect branches, or simply racemose. *Spikelets* few, $\frac{1}{3}$ — $\frac{1}{2}$ -inch long, 4—8-flowered. *Empty glumes* nearly equal, longer than the spikelet, 5—7-nerved. *Flowering glume* glabrous, deeply 2-fid, 9-nerved, with a circle of long hairs near the base, and with distant small pencils of hairs on margins and back, lateral awns as long as the glume, central awn $\frac{1}{3}$ longer than the lateral awns, straight, slightly twisted at bottom, awns and tops of florets purple, pedicel with tufts of long hairs. *Palea* truncate, or slightly bifid. *Scales* linear-oblong, acuminate, crowned with long cilia. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

The present and the following species, with their varieties, form an important part of the pastures of New Zealand at the present time, and, as they were still more abundant when the land was first stocked, no doubt much of the well-known fattening qualities of the original pasture was indebted to these grasses. Although many grasses are permanently destroyed by overstocking and other causes, the *Danthonias* appear to possess an inherent recuperative power, which enable them at any time when the destroying agency is removed to renew their growth and spread in abundance. This may be partly ascribed to their capacity of ripening abundance of seed, and their ready adaptation to climatic changes and differences of soil. DISTRIBUTION IN NEW ZEALAND: FROM THE NORTH CAPE TO STEWART ISLAND.

Reference to Plate XXXIII.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, styles, and stigmas. 9, 9', 9". Grain, different views.



Danthonia pilosa, R.Br.

8.—DANTHONIA SEMI-ANNULARIS.

NEW ZEALAND OAT GRASS.

(Plate XXXIV.)

DANTHONIA SEMI-ANNULARIS, R. Brown. Hook. fil., Fl. Tasm., II., 120.

ARUNDO SEMI-ANNULARIS, Labill. Pl. Nov. Holl., I., 26, t. 33.

DANTHONIA VARIA, Nees, in Pl. Preiss, II., 103.

DANTHONIA SETACEA, Hook. fil., Fl. Tasm., II., 121, not of R. Brown.

DANTHONIA ERIANTHA, Lindl. in Mitch. Three Exped., II., 307.

DANTHONIA GRACILIS, Hook. fil., Fl. N.Z., I., 304, t. 69B.

DANTHONIA SEMI-ANNULARIS, R. Brown. Hook. fil., Fl. N.Z., I., 304.

DANTHONIA SEMI-ANNULARIS, R. Brown. Hook. fil., Handb. N.Z. Flora, I., 333.

A VALUABLE perennial pasture grass, abundant from sea-level to 6000 feet altitude. *Flowers* November—January. *Culms* 1—2-feet high, glabrous. *Leaves* involute, filiform or flat, glabrous, sheathing leaves long; *ligule* 0, or a line of short hairs round the mouth of sheath, and a tuft of long hairs on each side. *Panicle* 3—5-inches long, contracted, open only when in flower, shortly branched. *Spikelets* few, $\frac{1}{3}$ — $\frac{1}{2}$ -inch long, 4—8-flowered. *Empty glumes* white or purplish, nearly equal, 5-nerved. *Flowering glume* glabrous, deeply 2-fid, 9-nerved, with a circle of long hairs under the lobes, and a second circle of shorter hairs near the bottom; lateral awns $\frac{1}{3}$ as long as the glume, central awn 5 times longer than the lateral awns, straight and slightly twisted at bottom; pedicel with tufts of long hairs. *Palea* bifid. *Scale* 3-lobed, and crowned with long cilia. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

This is a valuable pasture grass, proving permanent on dry uplands where introduced species die out; it is also well adapted as a fodder grass, having considerable bulk on good soil. In many districts of the South Island, before the introduction of exotic grasses, the natural pasture, of which this grass formed a prominent part, was known by the early settlers to be very fattening to stock, as on occasions when horses or cattle strayed into any remote valleys beyond the settlements, and remained for some time, they always became extremely fat. In the South Island, however, repeated burnings, and over-feeding by sheep and rabbits in some places, have destroyed this wealth of pasture. The varieties of this species are early grasses, supplying nutritious food at a time when most wanted, although the



Danthonia semiannularis, R.Br.

9.—DANTHONIA BUCHANANI.

BUCHANAN'S OAT GRASS.

(Plate XXXV.)

DANTHONIA BUCHANANI, Hook. fil., Handb. N.Z. Flora, I., 333.

A TALL, tufted, glabrous, perennial grass, found 1000—2000 feet altitude. *Flowers* January. *Culms* 2—3-feet high. *Leaves* 6—18-inches long, $\frac{1}{4}$ -inch broad, flat or involute, sheathing leaves short; *ligule* very short, truncate, membranous, lacerate on top. *Panicle* contracted, 6—8-inches long, branches few, in distant pairs, 1—2-inches long. *Spikelets* few, alternate on the branches and clustered near the ends. *Empty glumes* membranous, ovate-oblong, obtuse, serrate on top, 3-nerved, pale-yellow with white margins. *Staminiferous flowering glumes* dark-orange, linear-oblong, pilose, and fringed on the margins with long hairs, deeply 2-fid, 5-nerved, lobes obtuse, central awn as long as the glume, twisted at bottom and bent near the middle at an obtuse angle. *Palea* of staminiferous florets bifid at top, 2-nerved. *Fertile flowering glume* glabrous, thick and horny, shining, dark-orange, ovate, obtuse, entire and ciliate at top, 5-nerved. *Palea* of fertile floret linear-obtuse, entire, 1-nerved. *Scales* oblong-acute, crowned with short cilia. *Ovary* elongate, narrow. DISTRIBUTION OF SPECIES: SOUTH ISLAND, NEW ZEALAND.

NOTE.—The 5-nerved flowering glume of this species is a departure from the constant 9-nerved in *Danthonia*.

Little is known of this grass since it was first discovered near the Wanaka Lake, Otago, by the Geological Survey in 1864. It is a tall oat-like grass, the dark-orange spikelets of which attract the attention very readily, and suggest the idea of a cultivated plant. The horses used by the survey party, which remained at the main camp for some weeks, fed greedily upon this grass with great relish, and were noticed to prefer it to other grasses. The general appearance of this species is more that of a fodder plant than one peculiarly adapted for pasture, and it would no doubt repay the expense of an experimental trial if any of the residents near the locality were to collect the seed. DISTRIBUTION IN NEW ZEALAND: HECTOR'S CAMP, MATUKITUKI VALLEY, NEAR WANAKA LAKE.

Reference to Plate XXXV.: Fig. 1. Plant. 2. Spikelet. 3. Staminiferous floret (by mistake, stigmas have been drawn in this floret instead of anthers). 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume of staminiferous floret. 6. Palea of staminiferous floret. 7. Flowering glume of fertile floret. 8. Palea of fertile floret. 9. Scale. 10. Ovary, styles, and stigmas. 11, 11'. Grain, front and side views.

9.—DANTHONIA BUCHANANI.

BUCHANAN'S OAT GRASS.

(Plate XXXV.)

DANTHONIA BUCHANANI, Hook. fil., Handb. N.Z. Flora, I., 333.

A TALL, tufted, glabrous, perennial grass, found 1000—2000 feet altitude. *Flowers* January. *Culms* 2—3-feet high. *Leaves* 6—18-inches long, $\frac{1}{4}$ -inch broad, flat or involute, sheathing leaves short; *ligule* very short, truncate, membranous, lacerate on top. *Panicle* contracted, 6—8-inches long, branches few, in distant pairs, 1—2-inches long. *Spikelets* few, alternate on the branches and clustered near the ends. *Empty glumes* membranous, ovate-oblong, obtuse, serrate on top, 3-nerved, pale-yellow with white margins. *Staminiferous flowering glumes* dark-orange, linear-oblong, pilose, and fringed on the margins with long hairs, deeply 2-fid, 5-nerved, lobes obtuse, central awn as long as the glume, twisted at bottom and bent near the middle at an obtuse angle. *Palea* of staminiferous florets bifid at top, 2-nerved. *Fertile flowering glume* glabrous, thick and horny, shining, dark-orange, ovate, obtuse, entire and ciliate at top, 5-nerved. *Palea* of fertile floret linear-obtuse, entire, 1-nerved. *Scales* oblong-acute, crowned with short cilia. *Ovary* elongate, narrow. DISTRIBUTION OF SPECIES: SOUTH ISLAND, NEW ZEALAND.

NOTE.—The 5-nerved flowering glume of this species is a departure from the constant 9-nerved in *Danthonia*.

Little is known of this grass since it was first discovered near the Wanaka Lake, Otago, by the Geological Survey in 1864. It is a tall oat-like grass, the dark-orange spikelets of which attract the attention very readily, and suggest the idea of a cultivated plant. The horses used by the survey party, which remained at the main camp for some weeks, fed greedily upon this grass with great relish, and were noticed to prefer it to other grasses. The general appearance of this species is more that of a fodder plant than one peculiarly adapted for pasture, and it would no doubt repay the expense of an experimental trial if any of the residents near the locality were to collect the seed. DISTRIBUTION IN NEW ZEALAND: HECTOR'S CAMP, MATUKITUKI VALLEY, NEAR WANAKA LAKE.

Reference to Plate XXXV.: Fig. 1. Plant. 2. Spikelet. 3. Staminiferous floret (by mistake, stigmas have been drawn in this floret instead of anthers). 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume of staminiferous floret. 6. Palea of staminiferous floret. 7. Flowering glume of fertile floret. 8. Palea of fertile floret. 9. Scale. 10. Ovary, styles, and stigmas. 11, 11'. Grain, front and side views.



Danthonia Buchanani, Hook. fil.

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10.—DANTHONIA NUDA.

NAKED OAT GRASS.

(Plate XXXVI. A.)

DANTHONIA NUDA, Hook. fil., Fl. N.Z., II., 337.

DANTHONIA NUDA, Hook. fil., Handb. Flora N.Z., I., 337.

A SMALL sub-alpine grass, found at 3000—4000 feet altitude. *Flowers* December—January. *Culms* 4—10-inches high, slender. *Leaves* glabrous, shorter than the culms, very narrow, involute, sheathing leaves short; *ligule* 0, or a line of short hairs round the mouth of sheath, and long cilia on both sides. *Panicle* $\frac{1}{2}$ —2-inches long, of 6—10 erect spikelets, lower spikelets longest branched. *Spikelets* pale, purple, or greenish white, $\frac{1}{5}$ -inch long, 3—5-flowered. *Empty glumes* longer than the spikelets, 5-nerved. *Flowering glumes* glabrous, shortly 2-fid at the top, with a short central awn, 9-nerved, and with one pencil of hairs on each margin; pedicels with short tufts of hairs. *Palea* bifid. *Scales* broad, 3-lobed, and crowned with cilia. *Ovary* pear-shaped. *Stigmas* linear. *Grain* narrow-oblong. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This valuable little pasture grass is abundant on sub-alpine hills, but very apt to be overlooked from its small size and general resemblance to other grasses, such as small forms of *Poa*, or introduced *Fescues*. From its succulent nature, and as it belongs to the family which includes some of the most nutritious grasses in New Zealand, it may be considered as having some claim as a valuable sheep grass, and also, from being indigenous to the soil, it may prove more hardy and better adapted to those bleak hilly districts where it is found, than many of the introduced grasses. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: MOUNTAINS NEAR THE EAST COAST—Colenso. SOUTH ISLAND: MOUNTAINS OF NELSON (4000—5000 feet)—H. H. Travers; KAIHIKU HILLS, OTAGO—J. Buchanan.

Reference to Plate XXXVI. A: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Grain.

11.—DANTHONIA PAUCIFLORA.

FEW-FLOWERED OAT GRASS.

(Plate XXXVI. B.)

DANTHONIA PAUCIFLORA, R. Brown. Hook. fil., Fl. Tasm., II., 121, t. 162.

DANTHONIA PAUCIFLORA, R. Brown. Benth. Flora Australiensis, VII., 596.

A SMALL alpine pasture grass, found at 2000—5000 feet altitude. *Flowers* December—January. *Branches* prostrate, creeping, forming dense tufts of fine rigid leaves. *Culms* 3—6-inches high. *Leaves* glabrous, 1—3-inches long, rigid, involute, filiform, setaceous; *ligule* 0, or with a few hairs on each side of the sheath. *Panicle* ovoid, of few shortly pedicillate spikelets, sometimes reduced to 1 or 2. *Spikelets* $\frac{1}{5}$ -inch long, 2—4-flowered. *Empty glumes* longer than the spikelets, 7-nerved. *Flowering glume* glabrous, shortly 2-fid at top, with a short central awn, 9-nerved, fringed on the margins with hairs. *Palea* bifid at top, pedicels with short tufts of hairs. *Scales* broadest at top, and crowned with cilia. *Grain* ovate. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

This very small representative of the genus was recently detected in a collection from Mount St. Bathans, Otago, forwarded by W. Petrie. Its small rigid leaves do not recommend it as a pasture grass, yet, from its evident perennial habit, it may prove valuable on those higher altitudes where few grasses can exist. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: MOUNT ST. BATHANS, OTAGO (forming a beautiful sward)—W. Petrie.

Reference to Plate XXXVI. B: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Grain.



A. *Danthonia nuda*, *Hook. fil.*

B. " *pauciflora*, *R. Br.*

GENUS XVII.—DESCHAMPSIA, Beauvois.

Spikelets 2—3, rarely, 1-flowered. *Panicles* large, slender-branched, rarely contracted. *Empty glumes* 2, nearly equal. *Flowering glumes* 2—3, and a terminal imperfect one, truncate, 4-toothed, awn dorsel, short, straight, obtuse. *Palea* 2-nerved, 2-fid at the tip. *Scales* 2. *Stamens* 3. *Grain* free.

DISTRIBUTION OF GENUS: TEMPERATE REGIONS OF THE NORTHERN AND SOUTHERN HEMISPHERES.

1.—DESCHAMPSIA CÆSPITOSA.

TURFY HAIR GRASS.

(Plate XXXVII.)

AIRA KINGII, Fl. Antarct., 376, t. 135.

TRIODIA SPLENDIDA, Steudel.

AIRA AUSTRALIS, Raoul.

AGROSTIS AUCKLANDICA, Fl. Antarct., I., 96.

DESCHAMPSIA CÆSPITOSA, Beauv. Hook. fil., Fl. N.Z., I., 301

DESCHAMPSIA CÆSPITOSA, Beauv. Hook. fil., Handb. N.Z. Flora, I., 334.

A TALL, glabrous, shining, perennial grass, found from sea-level to 3500 feet altitude. *Flowers* December—February. *Culms* 1—3 feet high. *Leaves* involute, long or short; *ligule* long, acute. *Panicle* open, 3—12 inches long, one-sided, branches slender, whorled or fascicled, scaberulous. *Spikelets* $\frac{1}{6}$ — $\frac{1}{5}$ -inch long. *Empty glumes* nearly equal, linear-oblong, acute, 1—3-nerved. *Flowering glume* truncate and 4-toothed at the top, 5-nerved, awn basal, as long as the glume, pedicel with tufts of long hairs. *Palea* bifid at top, 2-nerved. *Scales* unequally 2-lobed. DISTRIBUTION OF SPECIES: A WIDELY-DIFFUSED GRASS IN THE TEMPERATE ZONES OF BOTH THE NORTHERN AND SOUTHERN HEMISPHERES, WITH THE SAME RANGE AS THE GENUS.

This very graceful showy grass is considered of little value in British agriculture, being deficient in nutriment, and not relished by any kind of stock. Its most favourite habitats are wet marshy land, and it can only be tolerated for the shelter it affords to smaller and less hardy species. It is seldom eaten by stock after the seed is shed, and, as regards its nutrient qualities, it will be seen from the Woburn experiments that, at the time of the seed ripening, it yielded at the rate of 10,209 lb. of green produce per acre, which lost in drying 6891 lb., and afforded of nutritive matter only 319 lb. Its cultivation therefore cannot be recommended, and it will probably disappear wherever the land is drained. Johnson, in his work on British grasses, says, of the tendency of this grass to form tussacs, "In the economy of nature, these tufts, so unsightly and disfiguring to the cultivated landscape, are valuable by contributing to elevate and solidify low lands liable to be overflowed by rivers, and, where they occur on hill and mountain slopes, by binding the spongy soil and preventing the slips which would leave them bare. DISTRIBUTION IN NEW ZEALAND: NORTH AND MIDDLE ISLAND (abundant).

Reference to Plate XXXVII.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Grain, natural size. 8'. Grain enlarged.



Deschampsia caespitosa, Palisot.

GENUS XVIII.—KŒLERIA, Persoon.

Spikelets 2—4-flowered, shortly pedicellate, shining. *Panicle* spike-like, densely cylindrical or interrupted. *Empty glumes* unequal or nearly equal. *Flowering glumes* bifid at the top, with a short straight, dorsal or nearly intermediate awn, or o, the lowest glume sessile, the upper on a short articulating rachis. *Palea* 2-nerved, bifid at tip, nearly as long as the glume. *Scales* 2. *Stamens* 3. *Grain* free. DISTRIBUTION OF GENUS: TEMPERATE REGIONS OF THE NORTHERN HEMISPHERE, AUSTRALIA, TASMANIA, NEW ZEALAND. *Etymology*: Named in honor of Professor Köler, an early writer on grasses.

1.—KŒLERIA CRISTATA.

CRESTED HAIR GRASS.

(Plate XXXVIII.)

KŒLERIA CRISTATA, Persoon. Hook. fil., Fl. N.Z., I., 305.

KŒLERIA CRISTATA, Persoon. Hook. fil., Handb. N.Z. Flora, I., 334.

A SHINING silvery-grey grass, found from sea-level to 4000 feet altitude. *Flowers* December—February. *Culms* 1—3-feet high. *Leaves* short, flat or involute, pilose; *ligule* short, rounded at top. *Panicle* erect, 3—5-inches long, narrow, often interrupted or lobed below, branches very short. *Spikelets* crowded, erect, imbricated, white or purplish, 2—3-flowered, $\frac{1}{6}$ — $\frac{1}{5}$ -inch long. *Empty glumes* unequal, 3-nerved. *Flowering glumes* glabrous, bifid and shortly awned at top, 5-nerved, rachis pilose. *Palea* nearly as long as the glume, bifid at top, 2-nerved. *Scales* unequally 2-lobed. DISTRIBUTION OF SPECIES: SAME AS THE GENUS.

This is an abundant grass in the South Island, found chiefly on dry places. It possesses very little nourishment, and therefore cannot be recommended for cultivation. All kinds of stock are said to refuse

it, but probably this opinion is based on the experience of rich British pastures, and it may still have some value in places subject to severe drought during exceptionally dry seasons, for, however poor the nutrient qualities of certain grasses may be, they enable the stockowner to preserve his stock till better pasture is more abundant. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: AGLIONBY PLAINS—Munro; CANTERBURY PLAINS AND ACHERON VALLEY (4000 feet)—Travers, Armstrong; SOUTHERN ALPS—Sinclair and Haast; NELSON MOUNTAINS—H. H. Travers; OTAGO LAKE DISTRICT—Hector and Buchanan; OTAGO AND SOUTHLAND (abundant)—Buchanan.

Reference to Plate XXXVIII.: Fig. 1, 1'. Large and small size of plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale.



Koeleria cristata, Persoon.

GENUS XIX.—TRISETUM, Kunth.

Spikelets 2—3-flowered, rarely 4-flowered. *Panicles* open or contracted. *Empty glumes* 2, unequal. *Flowering glumes* 2—3, with a terminal imperfect one, 2-fid at the tip; awn from between the divisions twisted and recurved. *Palea* 2-nerved, 3—4-toothed at top. *Scales* 2. *Grain* free, glabrous. DISTRIBUTION OF GENUS: TEMPERATE AND SUB-ALPINE REGIONS OF BOTH NORTHERN AND SOUTHERN HEMISPHERES. *Etymology*: Name “Trisetum,” Latin, from the flowering glume being sometimes 3-awned.

ARRANGEMENT OF THE SPECIES:—

| | | | |
|--|-----|-----|----------------------------|
| Glabrous, shining, 1—2-feet high. Panicle lax, spreading | ... | ... | 1. <i>T. antarcticum</i> . |
| Downy, 6—12-inches high. Panicle spiciform | ... | ... | 2. <i>T. subspicatum</i> . |
| Pilose, 1—3-feet high. Panicle slender, contracted | ... | ... | 3. <i>T. Youngii</i> . |

1.—TRISETUM ANTARCTICUM.

SHINING OAT GRASS.

(Plate XXXIX.)

AIRA ANTARCTICA, Forst.

AVENA ANTARCTICA, Rœm. and Sch.

AVENA FORSTERI, Kunth.

DANTHONIA ANTARCTICA, Sprengel.

DANTHONIA PALLIDA, A. Cunn.

TRISETUM ANTARCTICUM, Trinius. Hook. fil., Fl. N.Z., I., 302, t. 68B.

TRISETUM ANTARCTICUM, Trinius. Hook. fil., Handb. N.Z. Flora, I., 335.

A GLABROUS, shining, perennial grass, found from sea-level to 6000 feet altitude. *Flowers* December—February. *Culms* 1—2-feet high. *Leaves* flat or involute, long or short, often setaceous, pilose, becoming scaberulous after casting the hairs; *ligule* short, truncate, often with long silky hairs on each

side of the sheath. *Panicle* erect, slender, open or contracted, 2—12-inches long, branches short. *Spikelets* $\frac{1}{6}$ — $\frac{1}{4}$ -inch long, shining white, or pale green, 3—4-flowered. *Empty glumes* unequal, 3-nerved. *Flowering glumes* deeply 2-fid, 5-nerved, with silky hairs at base; awn recurved, as long as or longer than the glume. *Palea* 4-toothed and lacerate at top, 2-nerved. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This valuable grass is distributed abundantly in both Islands, although it may be said to attain its maximum of growth in the South, where it becomes an important element in the pasture. It varies much in size and amount of contraction in the panicle, from the weak delicate form of the Tararua Mountain, Wellington, at 5000 feet altitude, to the large robust form from the Clutha or Mataura Valleys, but they all possess the same beautiful lustre which attracts notice as an ornamental plant. It is only in the South Island where it attains a size which would entitle it to be considered as a fodder plant, and it might be often judiciously mixed with *Lolium perenne* for this purpose. One strong argument in favour of the cultivation of indigenous grasses is their great vitality, which may sometimes be observed near homesteads in the South, where, after enclosed paddocks having been carefully ploughed and sown with some popular exotic grass, such as *Lolium perenne*, it will be found that the natural growth of indigenous species, such as the present, has filled the ditches, and covered the waste places along the fences with a better and more permanent crop than that cultivated in the adjoining paddocks, and which it ultimately displaces. DISTRIBUTION IN NEW ZEALAND: NORTH AND SOUTH ISLAND (abundant).

Reference to Plate XXXIX.: Fig. 1, 1'. Plant, showing open and contracted panicles. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, styles, and stigmas.



Trisetum antarcticum, *Trinius*.

2.—TRISETUM SUBSPICATUM.

SPIKED OAT GRASS.

(Plate XL. A.)

TRISETUM SUBSPICATUM, Beauv. Hook. fil., Flora Antarct, I., 97.

TRISETUM SUBSPICATUM, Palisot. Hook. fil., Handb. N.Z., Flora, I., 335.

A SMALL densely-tufted alpine grass, found from 500—5000 feet altitude. *Flowers* January. *Culms* 4—18-inches high. *Leaves* flat, as long as or shorter than the culms, downy; *ligule* short, rounded at top, lacerate. *Panicle* dense, subcylindric, spiciform, 1—4-inches long. *Spikelets* shortly pedicelled, imbricate, $\frac{1}{6}$ — $\frac{1}{4}$ -inch long, 2—3-flowered, pale greenish white, shining. *Empty glumes* shorter than the spikelet, unequal, very acute or cuspidate, 3-nerved. *Flowering glumes* 2, cuspidate, 5-nerved, awn dorsal, recurved, as long as or longer than the glume, inserted below the 2-cuspidate tip, pedicel tufted with hairs. *Palea* bifid, 2-nerved. DISTRIBUTION OF SPECIES: ARCTIC EUROPE, ASIA, AMERICA, AND ALPS OF THE SAME CONTINENTS; SOUTH AMERICA, FUEGIA, AUSTRALIA, TASMANIA; AUCKLAND, CAMPBELL, AND CHATHAM ISLANDS; NEW ZEALAND.

This grass is apparently confined to the South Island, where even it is at present but little known. Hooker says of it in his Antarctic Flora, "Few grasses have so wide a range as this, nor am I acquainted with any other Arctic species which is equally an inhabitant of the opposite polar regions. In Europe it is found at a very great elevation on the Alps and Pyrenees, as also in Lapland. In Asia it frequents the Altai Range, the northern parts of Siberia and Kamschatka, from whence it crosses to Kotzebue's Sound, and is apparently more generally distributed through Arctic America than in the Old World, from the utmost limits of polar vegetation in Melville Island, throughout Greenland and the Arctic Islands, the Arctic sea-coast, Labrador, Canada, and the Rocky Mountains." It seems improbable that a grass of such vitality and adaptation could be otherwise than valuable, and so no doubt it will prove to be when stockowners are enabled to distinguish it from other species. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: LAKE GUYON DISTRICT, NELSON (5000 feet)—H. H. Travers; MARLBOROUGH—Kirk; UPPER AWATERE VALLEY, MARLBOROUGH—Sinclair; HOPKINS RIVER, CANTERBURY (2500 feet)—Haast; OTAGO LAKE DISTRICT (3000 feet)—Hector and Buchanan; MOUNT ST. BATHANS, OTAGO (5000 feet)—W. Petrie; WESTERN SLOPES OF MOUNT COOK (5000 feet)—A. McKay.

Reference to Plate XL. A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale.

3.—TRISETUM YOUNGII.

YOUNG'S OAT GRASS.

(Plate XL. B.)

TRISETUM YOUNGII, Hook. fil., Handb. N.Z. Flora, I., 335.

A TALL perennial alpine grass, found from 3000—5000 feet altitude. *Flowers* January. *Culms* erect, 1—3-feet high, glabrous, shining. *Leaves* flat, $\frac{1}{6}$ — $\frac{1}{4}$ -inch broad, and sheaths pilose; *ligule* short, rounded at top and lacerate. *Panicle* 3—6-inches long, pale colour, branches very short with few spikelets. *Spikelets* $\frac{1}{6}$ — $\frac{1}{5}$ -inch long, shining, 1—2-flowered. *Empty glumes* unequal, broad, acute or cuspidate, 3-nerved, as long as or shorter than the spikelet. *Flowering glumes* 2-cuspidate, nearly glabrous; awn dorsal, stout, recurved, inserted below the 2-cuspidate tip, pedicel with silky hairs. *Palea* 4-toothed at tip, 2-nerved. DISTRIBUTION OF SPECIES: NEW ZEALAND.

Owing to the limited distribution of this grass its true value is little known, but the large size and succulent foliage which it attains recommend it to notice as a species that will repay the trouble of cultivation. According to Mr. H. H. Travers, who has recently visited the Tararua Mountain, it is there abundant, at an elevation of 5000 feet, and forms large patches of close growth, which, if cut, would produce bulky fodder. It thus appears to be a grass worthy of attention, and would no doubt prove a valuable acquisition to both farmer and grazier at lower altitudes. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: TARARUA MOUNTAINS (5000 feet)—H. H. Travers; SOUTH ISLAND: MACAULAY VALLEY (3000—4000 feet)—Haast and Young.

Reference to Plate XL. B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7, 7'. Scales.



A. *Trisetum subspicatum*, *Palisot*.
 B. " *Youngii*, *Hook. fil.*

